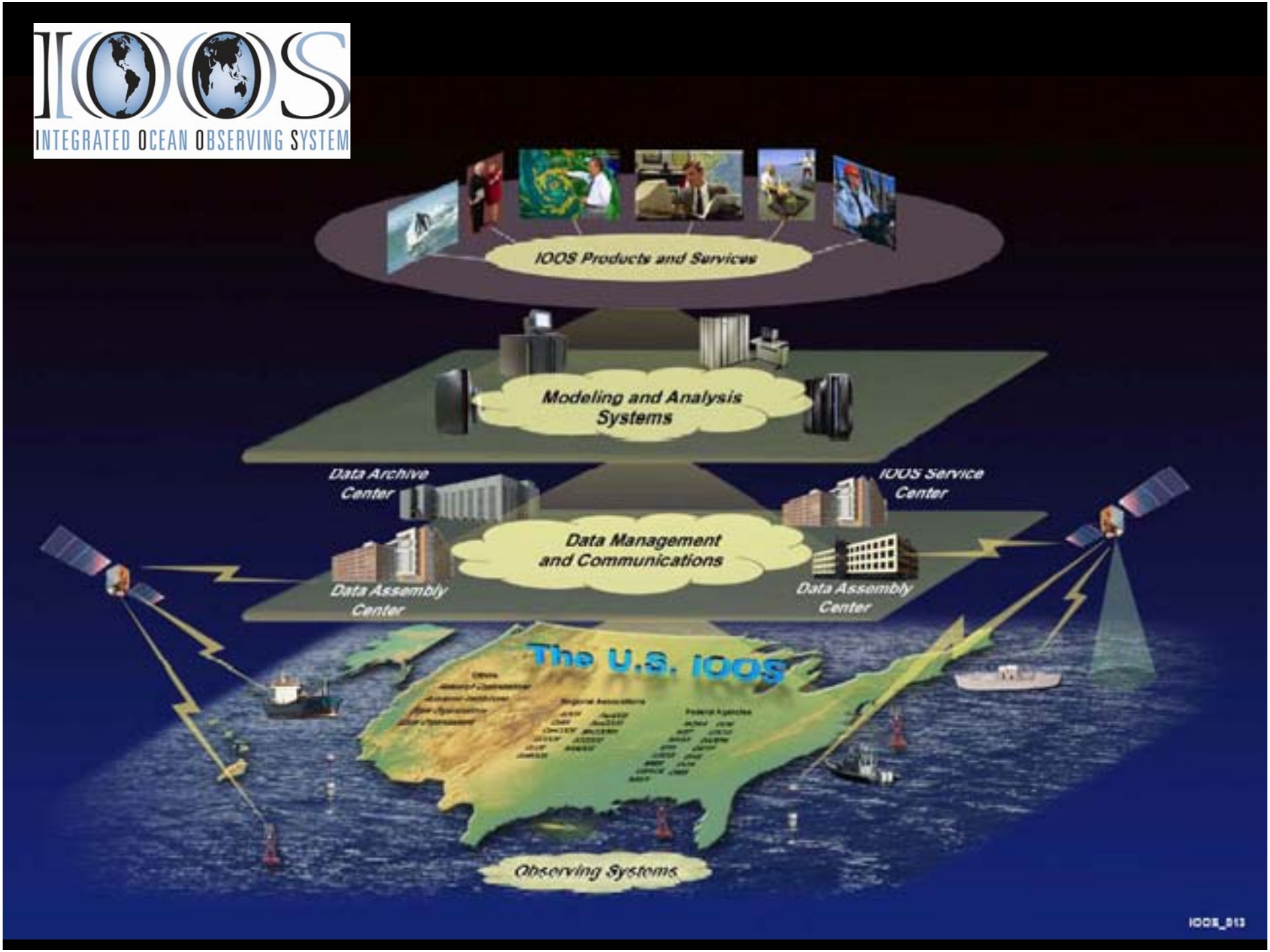
Washington's newest buoy:

Part of the IOOS-NANOOS system

IOOS
INTEGRATED OCEAN OBSERVING SYSTEM

NANOOS


IOOS
INTEGRATED OCEAN OBSERVING SYSTEM
IOOS Products and Services
Modeling and Analysis Systems
Data Archive Center
IOOS Service Center
Data Management and Communications
Data Assembly Center
Data Assembly Center
The U.S. IOOS
Observing Systems
IOOS_013

NFRA National Federation of Regional Associations for Coastal and Ocean Observing

Diverse Needs Require a Regional Approach

AOOS Alaska Ocean Observing System

NANOOS

CeNCOOS

SCCOOS Southern California Coastal Ocean Observing System

GLOS Great Lakes Observing System

NERACOOS Northeastern Regional Association of Coastal Ocean Observing Systems

MACOORA Mid-Atlantic Coastal Ocean Observing Regional Association

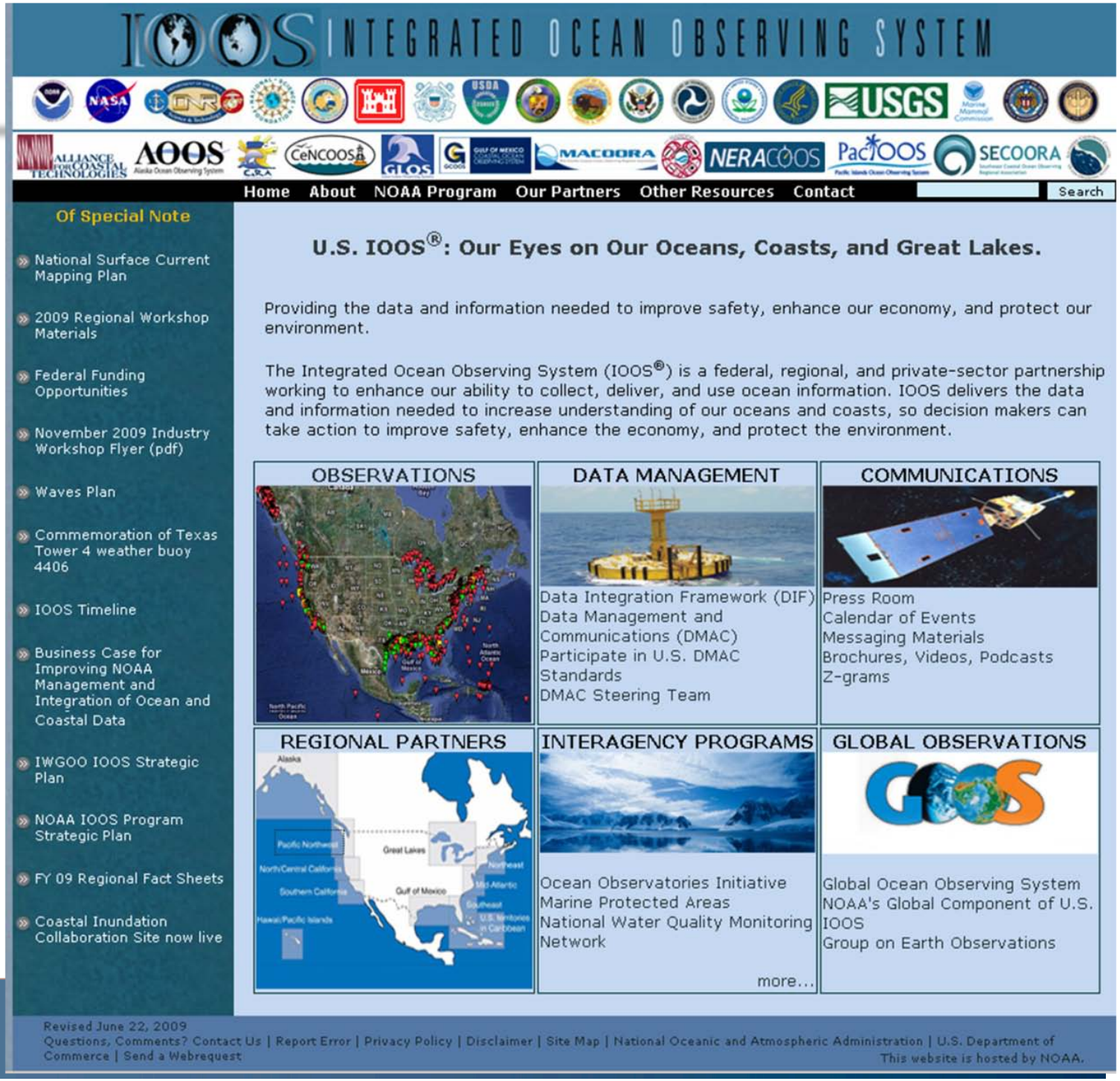
SECOORA Observing our Oceans

PacIOOS Pacific Islands Ocean Observing System

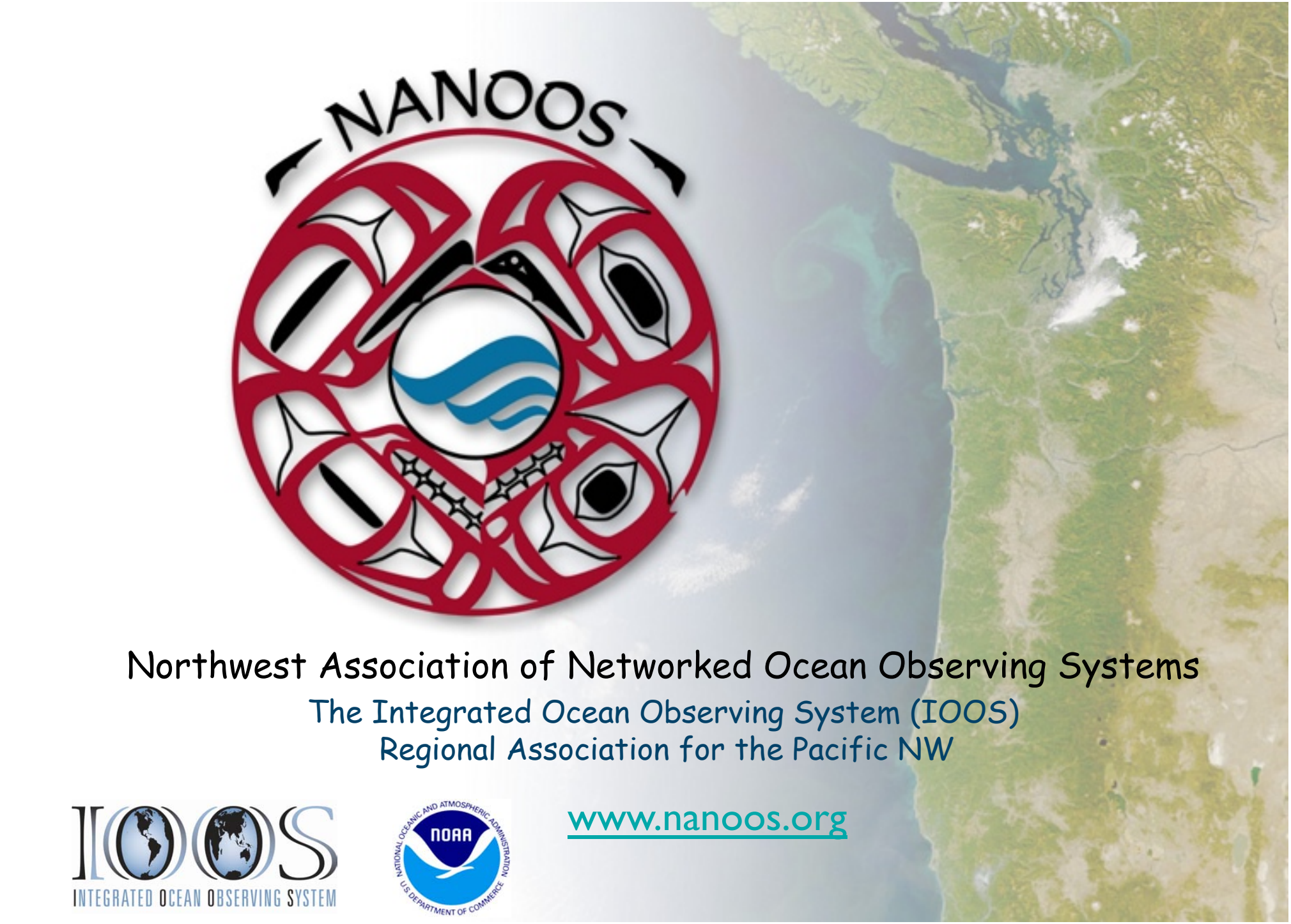
GCOOS Gulf of Mexico Coastal Ocean Observing System

CaRA Caribbean Regional Association

www.ioos.gov



IOOS®



Northwest Association of Networked Ocean Observing Systems

The Integrated Ocean Observing System (IOOS)
Regional Association for the Pacific NW

IOOS
INTEGRATED OCEAN OBSERVING SYSTEM

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

www.nanoos.org

NANOOS Governing Council Members 1/2010

1. Ocean Inquiry Project
2. OR Dept of Land Conservation & Development
3. Surfrider Foundation
4. The Boeing Company
5. Oregon State University
6. Puget Sound Partnership
7. University of Washington
8. WET Labs, Inc.
9. Oregon Health and Sciences University
10. Quileute Indian Tribe
11. OR Dept of Geology and Mineral Industries
12. Humboldt State University
13. Marine Exchange of Puget Sound
14. WA Dept of Ecology
15. Pacific Northwest National Laboratory
16. Port of Newport
17. Puget Sound Harbor Safety Committee
18. Sound Ocean Systems, Inc.
19. Council of American Master Mariners
20. Hood Canal Salmon Enhancement Group
21. Pacific Northwest Salmon Center
22. Northwest Indian Fisheries Commission
23. Sea-Bird Electronics, Inc.
24. Western Association of Marine Laboratories
25. Science Applications International Corporation
26. OR Dept of Fish and Wildlife
27. King County Dept Natural Resources & Parks
28. Quinault Indian Nation
29. Western Resources and Applications
30. OR Dept of State Land
31. Columbia River Crab Fisherman's Association
32. Port of Neah Bay
33. Northwest Research Associates
34. Pacific Ocean Shelf Tracking Project
35. WA Dept of Fish and Wildlife
36. Northwest Aquatic and Marine Educators
37. Seattle Aquarium
38. NOAA Northwest Fisheries Science Center
39. Port Gamble S'Klallam Tribe
40. The Nature Conservancy
41. Portland State University
42. NOAA Olympic Coast National Marine Sanctuary
43. VENUS/University of Victoria
44. University of Oregon

Industry
Tribal Government
NGO
Academia/Research
Federal/State/Local Government

Stakeholder Priorities

The NANOOS GC selected five areas from among results of numerous regional workshops as the highest regional priorities because "these issues represent those having the greatest impact on PNW citizenry and ecosystems and, we believe, are amenable to being substantively improved with the development of a PNW RCOOS":

- Maritime Operations
- Ecosystem Impacts, including hypoxia and HABs
- Fisheries
- Mitigating Coastal Hazards
- Climate, including ocean acidification

These priorities were put forth in our NANOOS proposal and are being addressed by the development of our regional coastal ocean observing system (RCOOS).

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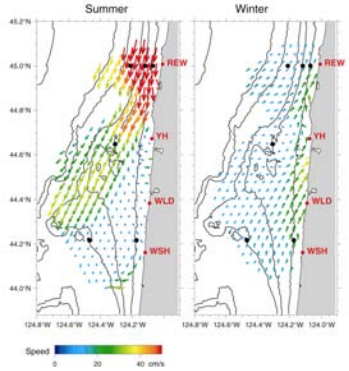
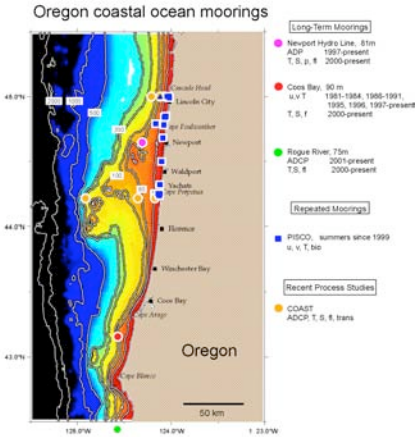
NANOOS RCOOS

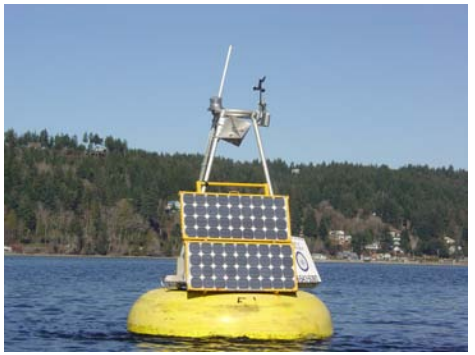


Current mapping

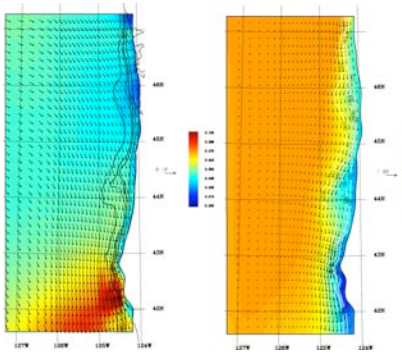


Shelf moorings

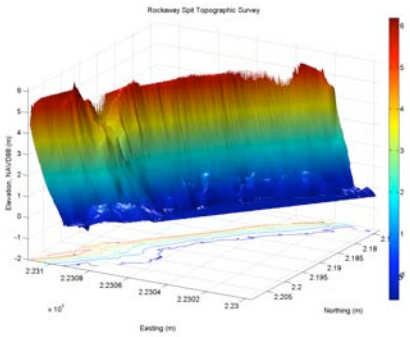
Beach/shoreline monitoring



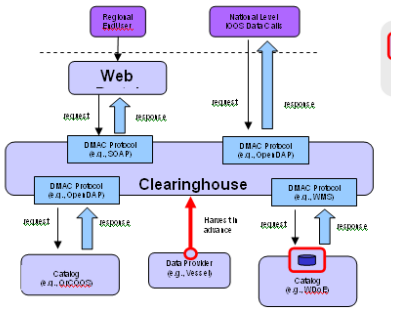
Estuary monitoring



Circulation models



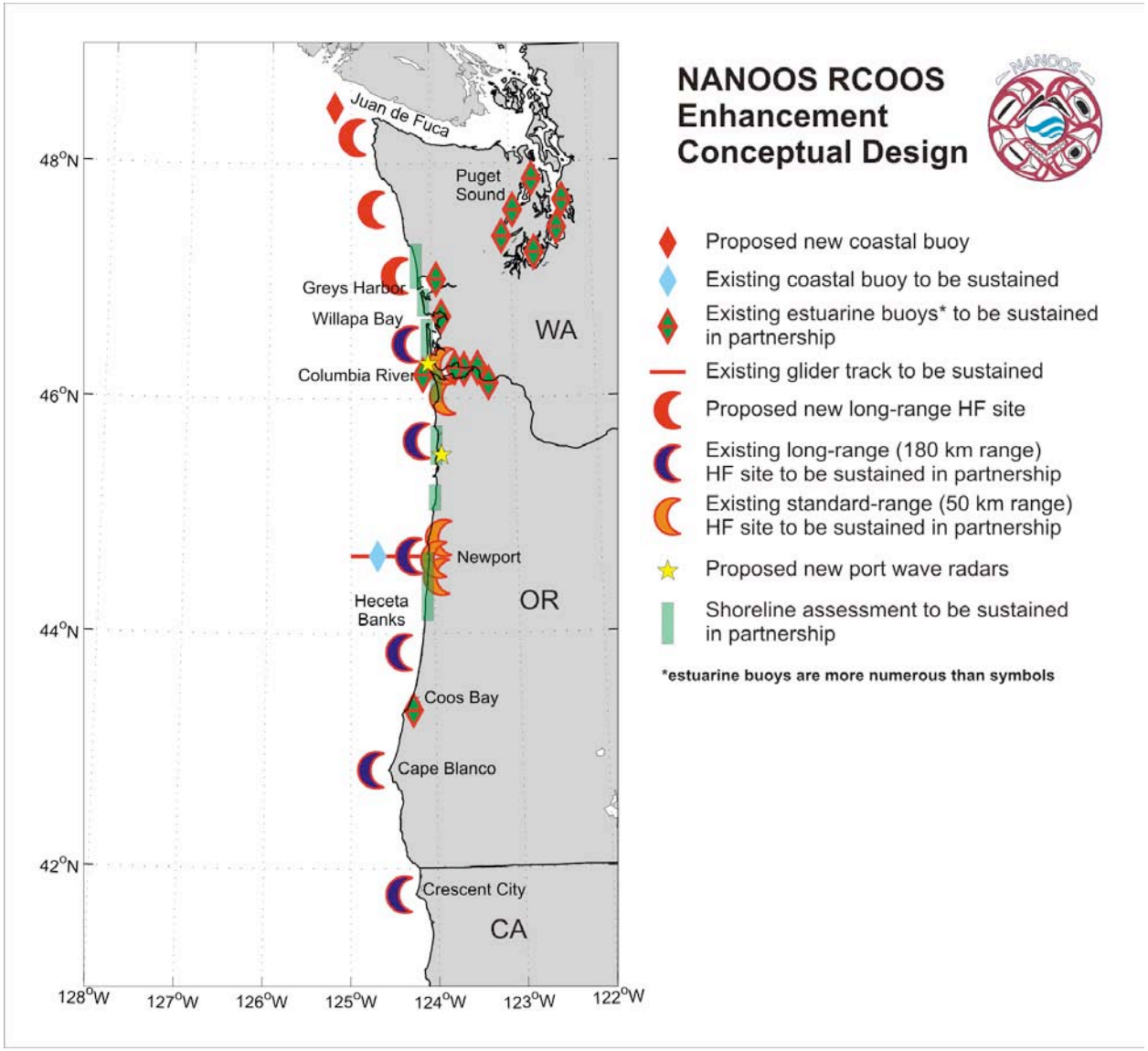
Shoreline change models



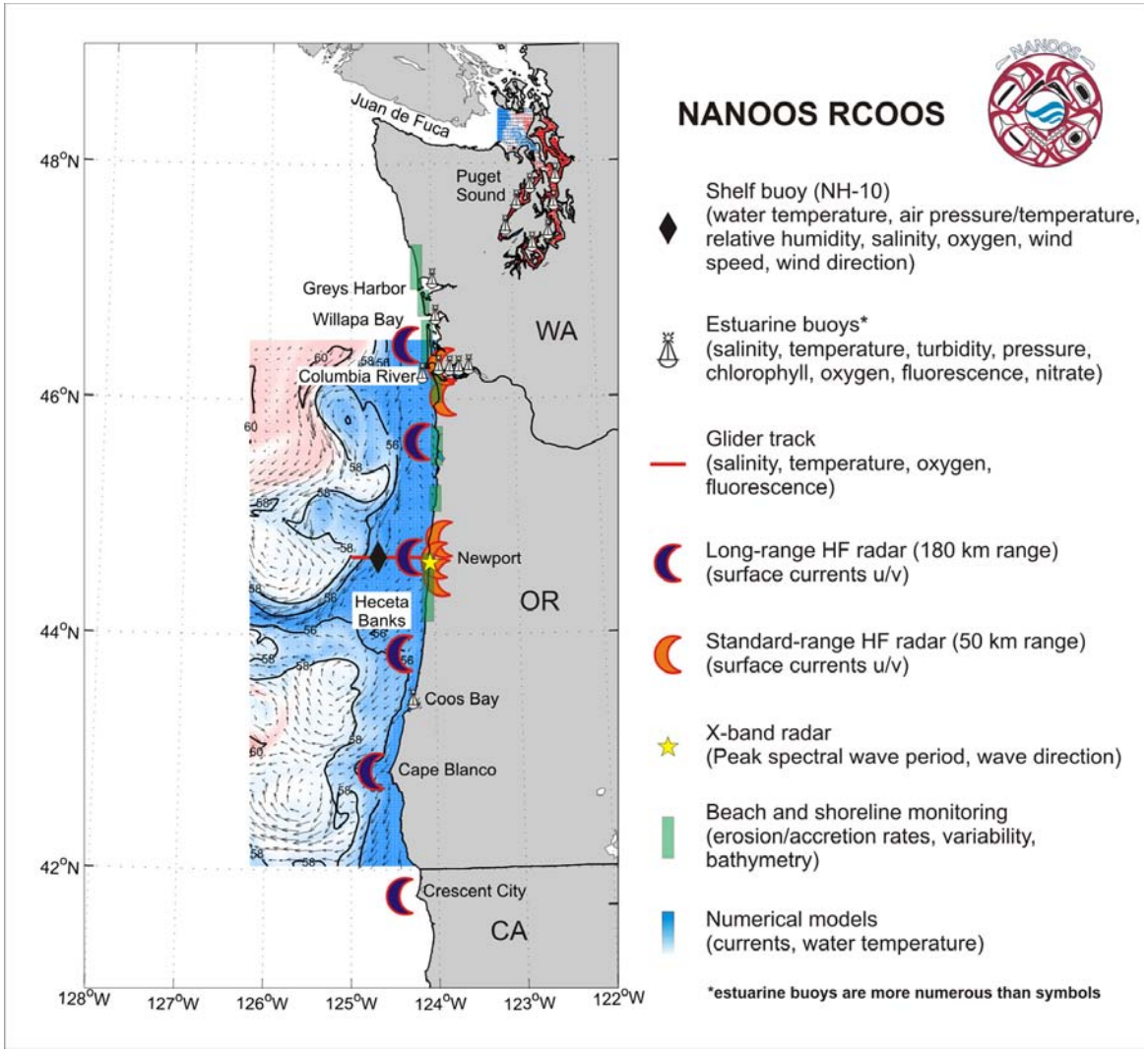
Data Management & Communications

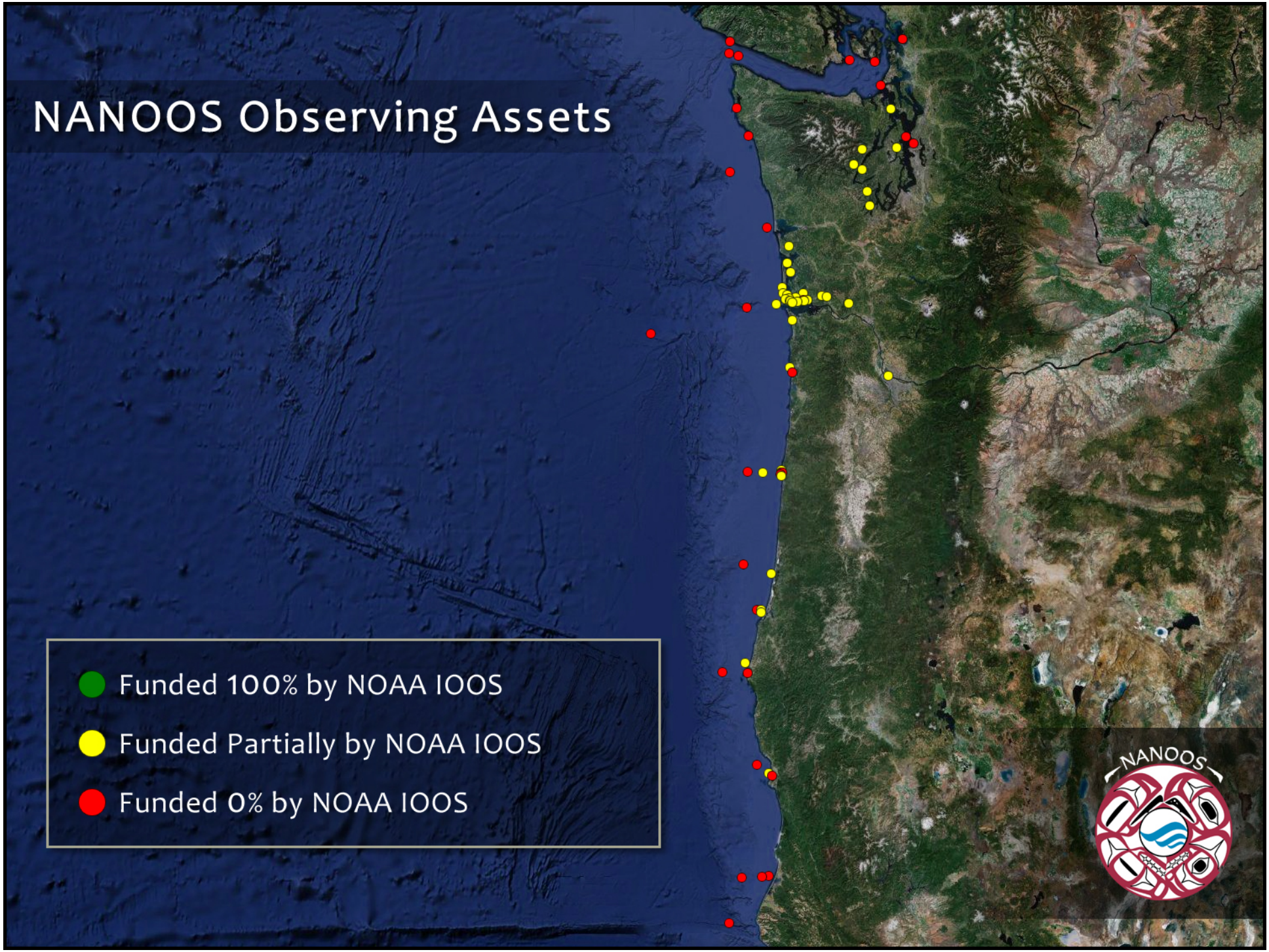
Education/Outreach

NANOOS RCOOS Conceptual Design



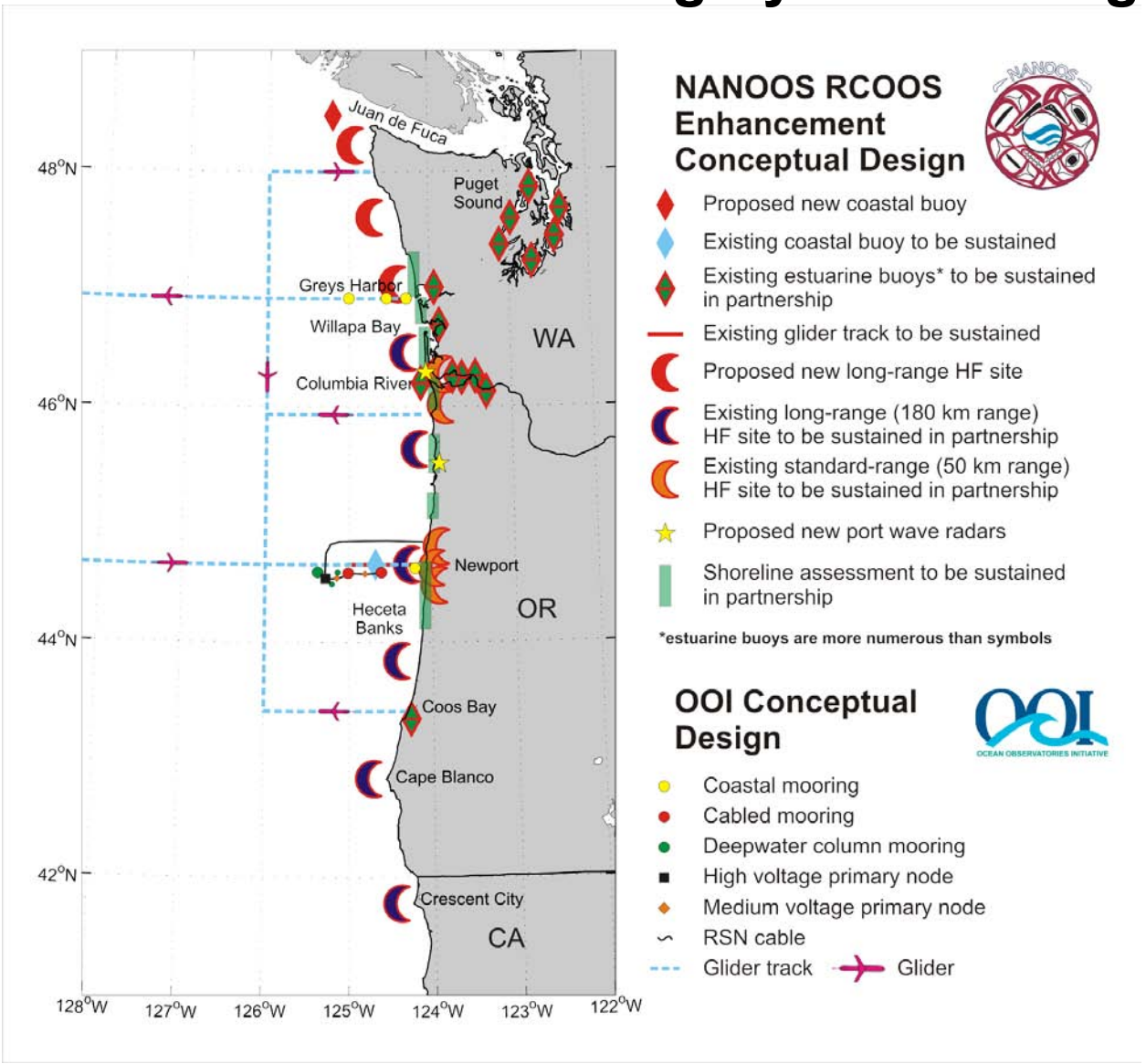
NANOOS RCOOS: 2007-2009 Implementation




NANOOS Observing Assets
Funded 100% by NOAA IOOS
Funded Partially by NOAA IOOS
Funded 0% by NOAA IOOS
NANOOS

NANOOS
Northwest Association of Networked Ocean Observing Systems
Washington - Oregon - Northern California

PNW Ocean Observing Systems Design



A multi-platform high-resolution coastal ocean observing sensor array for researching Washington coastal waters and ecosystem response to climate change

A University of Washington proposal to the Murdock Charitable Trust

29 June 2009

The view:

Existing:

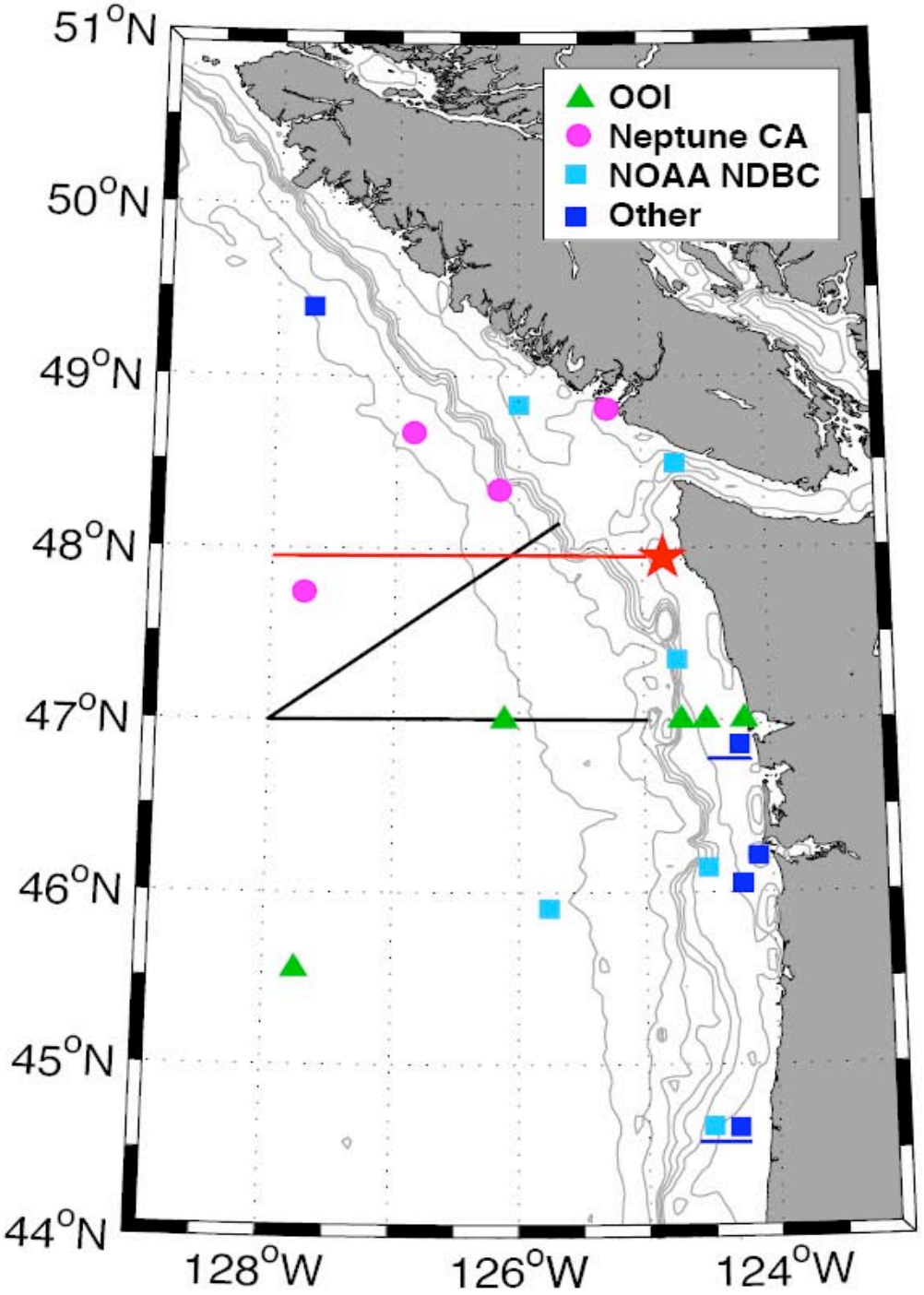
Most only surface T, except off OR & gliders

Previous:

7-y NSF-funded glider tracks

Planned:

Still a gap off WA that the proposed mooring ★ and glider would fill



APPLIED PHYSICS LABOR

Science Issues

- WA coast is under sampled, physical dynamics are poorly resolved
- WA coast has seasonal hypoxia, strong inter-annual variation, but dynamics are different than off OR
- WA coast has a harmful algal bloom (HAB) "hot-spot" at Juan de Fuca eddy
- WA coast impacted by ocean acidification, as is whole Pacific coast
- Current model accuracy is limited by data input

Hoh Indian Tribe
2464 Lower Hoh Road
Forks WA 98331

Makah Tribe
P.O. Box 115
Neah Bay, WA 98357

Quileute Tribe
P.O. Box 279
LaPush, WA 98350

Quinault Indian Nation
P.O. Box 189
Taholah, WA 98587

Office of the Governor
P.O. Box 40002
Olympia, WA 98504

RESOLUTION OF THE Olympic Coast Intergovernmental Policy Council
Resolution No. 2007-10-29-001

Whereas, the Olympic Coast Intergovernmental Policy Council (IPC) is a Tribal, State, Federal organization created through an MOA adopted January 30, 2007, the purpose of the Council is to provide an effective and efficient forum for communication and exchange of information and policy recommendations regarding the management of marine resources and activities within the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS);

Whereas, the coastal treaty tribes operate under their respective constitutions, Treaties of Neah Bay, and Olympia;

Whereas, the State of Washington operates under the State of Washington Constitution, Centennial Accord and the Governors proclamation of April 28, 2005;

Whereas, the Olympic Coast IPC recognizes that management of marine resources within OCNMS can be improved by dialogue among the governments within the boundaries of the OCNMS;

Whereas, the IPC recognizes that it is only through informed management that marine resources can be sustained for future generations;

Whereas, during a regular meeting of IPC on October 29, 2007 at Taholah, Washington, the IPC adopted

Whereas, the ocean research and monitoring initiative defines the following priority programs for the initial work of the IPC: (1) Rockfish Assessment; (2) Habitat Surveys; (3) Ocean Monitoring Buoys; (4) Long Range High Frequency Radar; and (5) Coastal Margin Observation Program;

NOW, THEREFOR, BE IT RESOLVED, that the IPC does hereby approve the Ocean Research and Monitoring Initiative.

Dave Hudson
Hoh Indian Tribe

James R. Woods
Makah Indian Tribe

Melvin Moon Jr.
Quileute Indian Tribe

Ed Johnstone
Quinault Nation

Kathleen Drew
Washington State

The above resolution was adopted at a regular meeting with the presence of a quorum of the Olympic Coast Intergovernmental Policy Council at **Taholah, Washington** on the **29th day of October, 2007** by a **consensus**.

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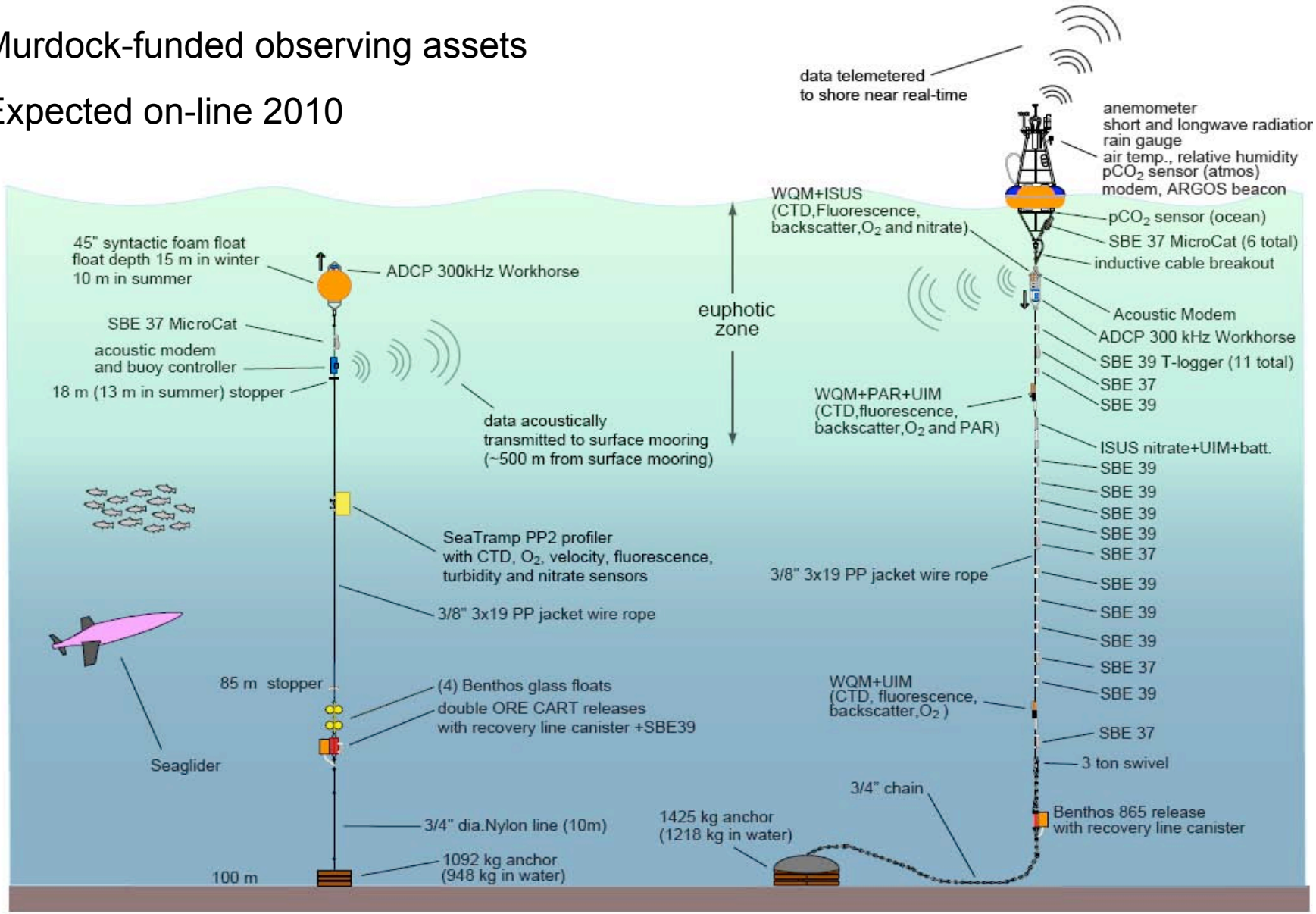
Murdock-funded observing assets

Expected on-line 2010




Ċhá'ba
"Whale Tail"


Čhə́ba'
"Whale Tail"

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- The buoy is the most sophisticated buoy to be deployed off Washington and will give us unprecedented data for this location.

- It will record water temperature, salinity, oxygen, nutrients, chlorophyll from algae, water currents, pH, carbon dioxide, and particles, as well as a host of weather measurements, such as wind and air temperature.

- The information from this observing array will give us keen insight into the physical and atmospheric dynamics of the WA coast. The data will be readily used to aid the accuracy of computer models of both the ocean and weather.

- The buoy will be used specifically to study:
  - Ocean acidification, not only so we know the status on the WA coast but also about the oceanic waters coming into Puget Sound.
  - Oxygen, which we know has caused fish kills both on the coast and in Puget Sound.
  - Algal blooms, both ones that feed our food web and ones that can be harmful or toxic.

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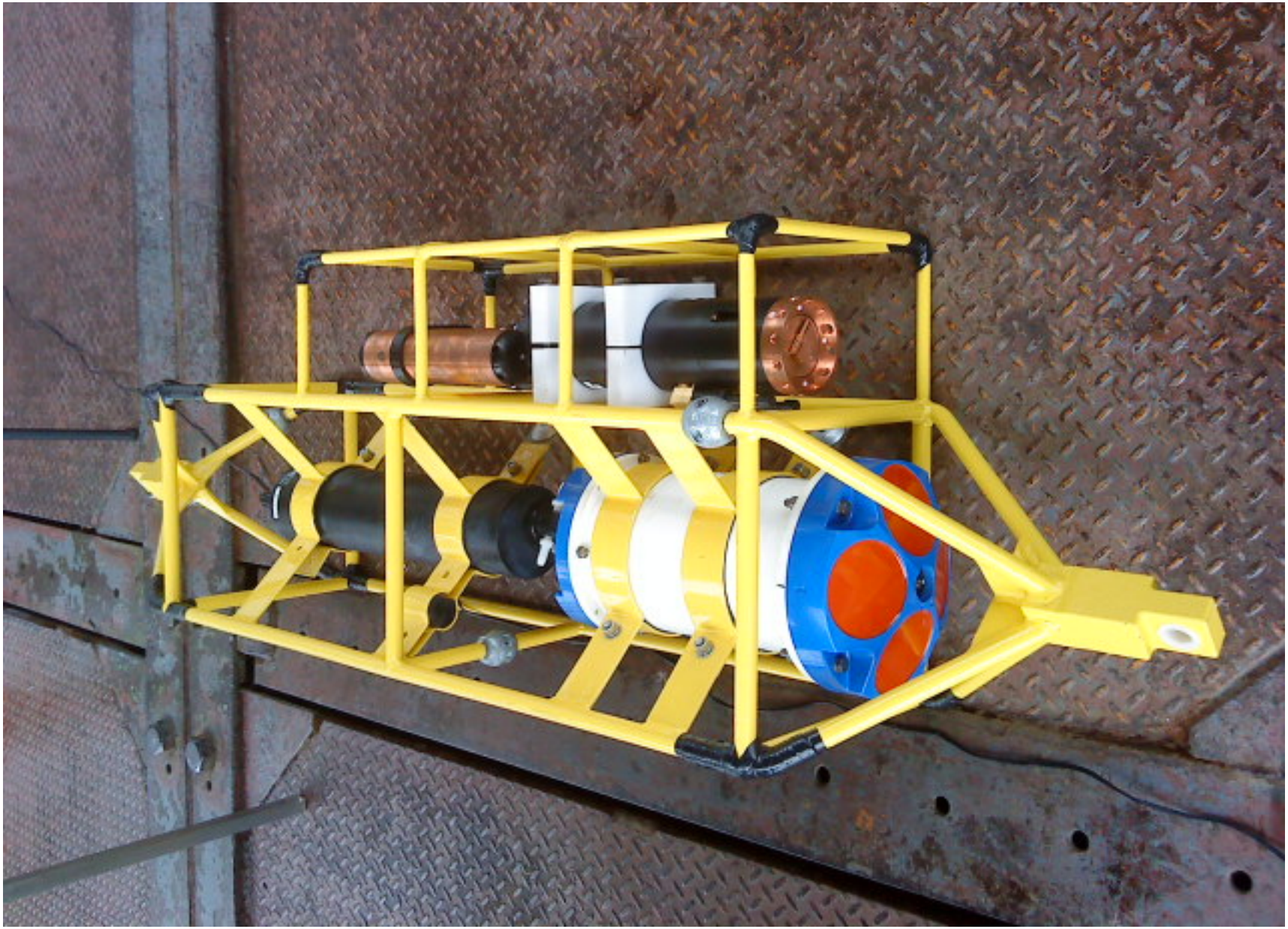
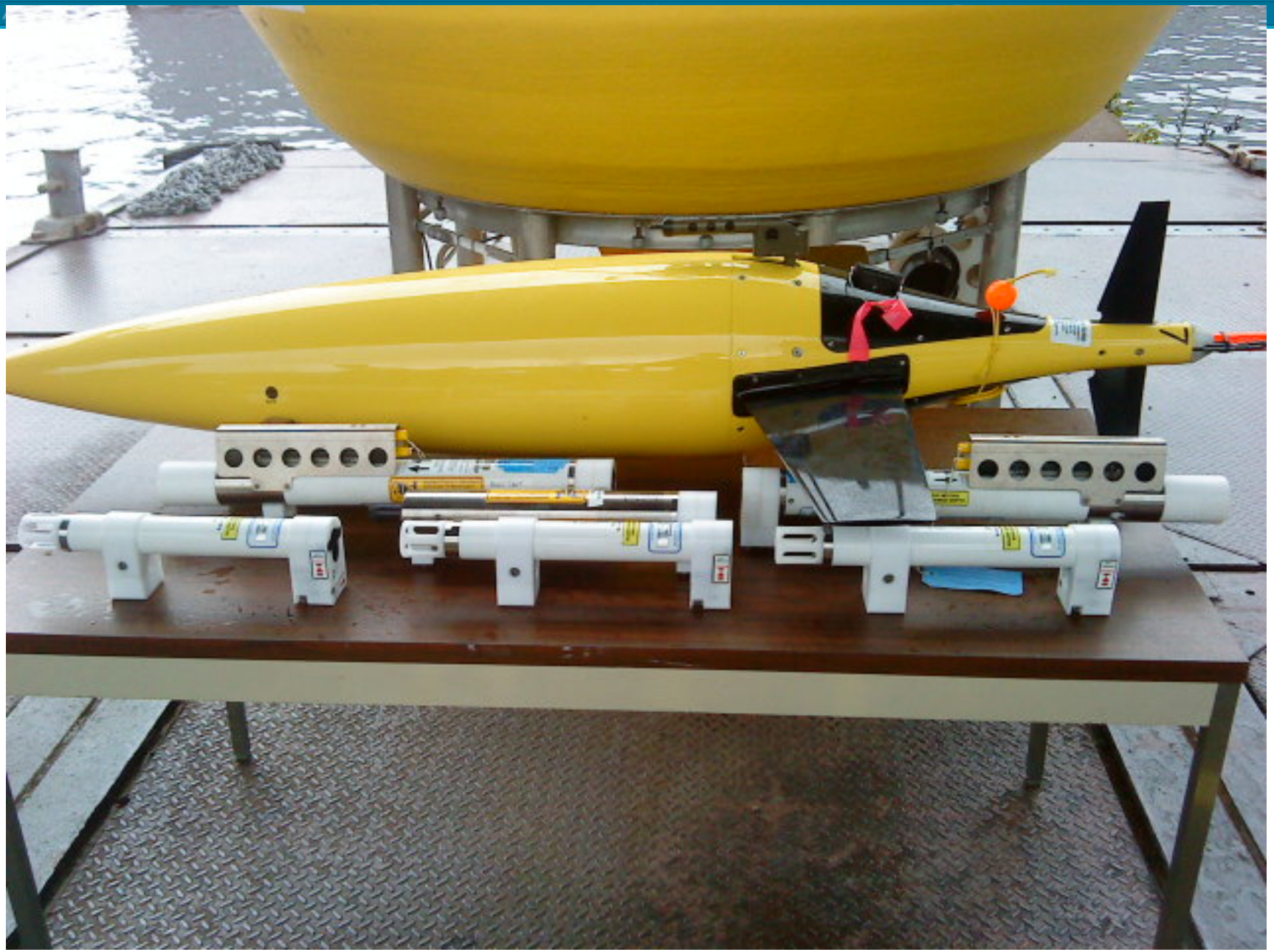
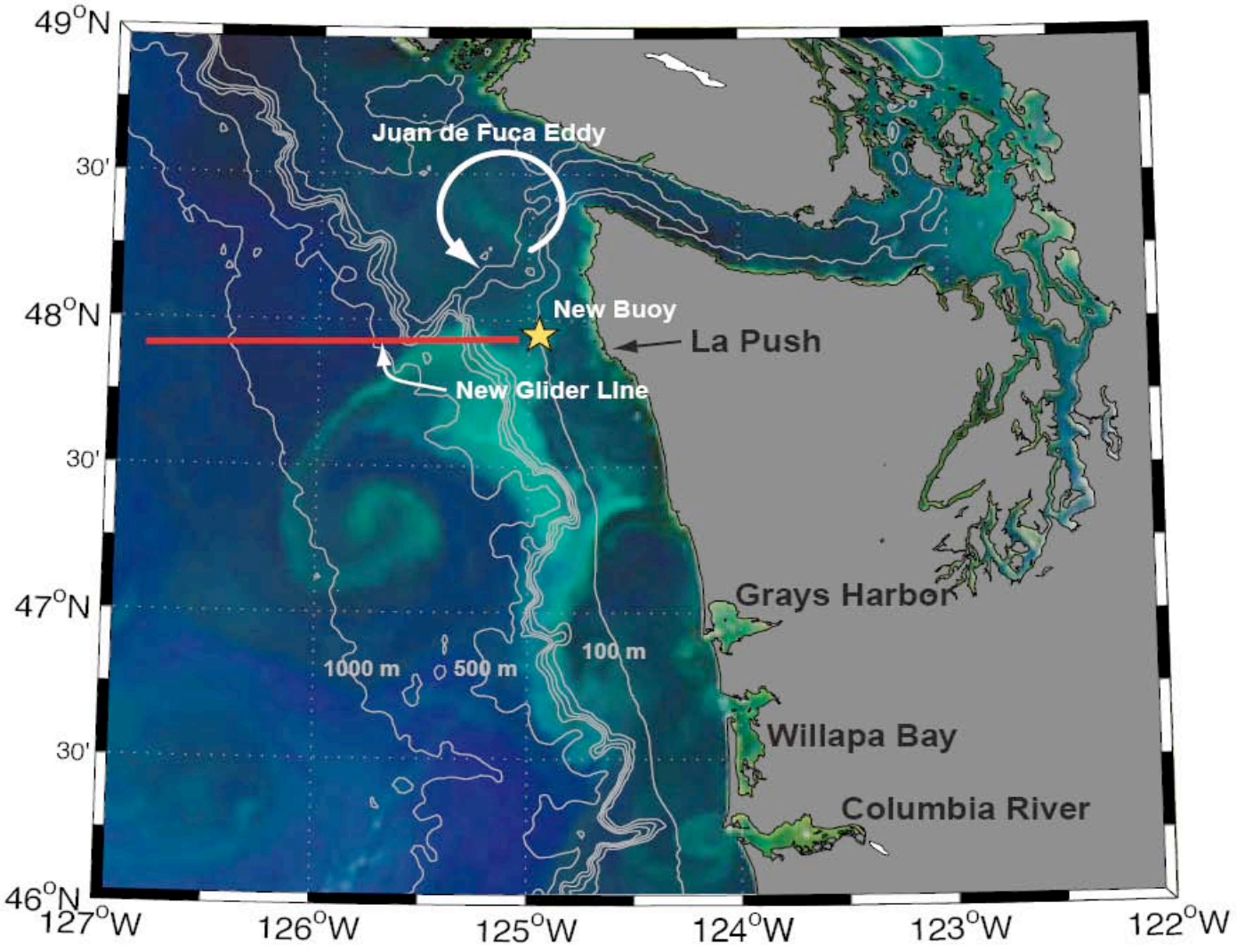


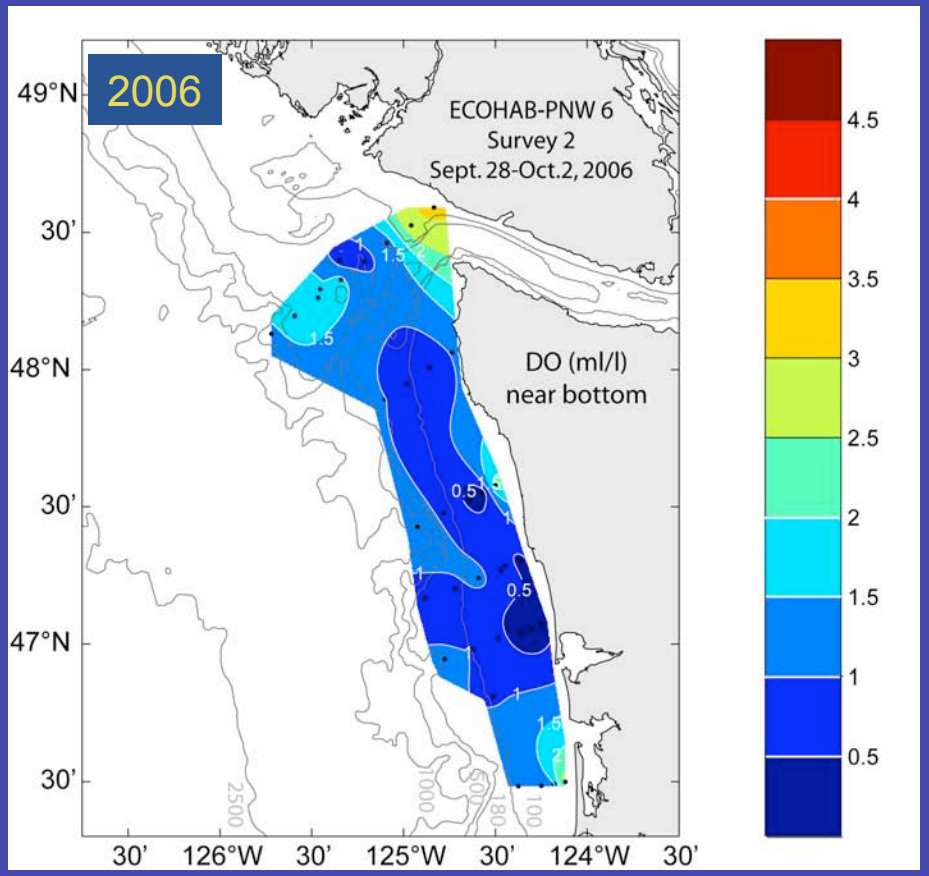


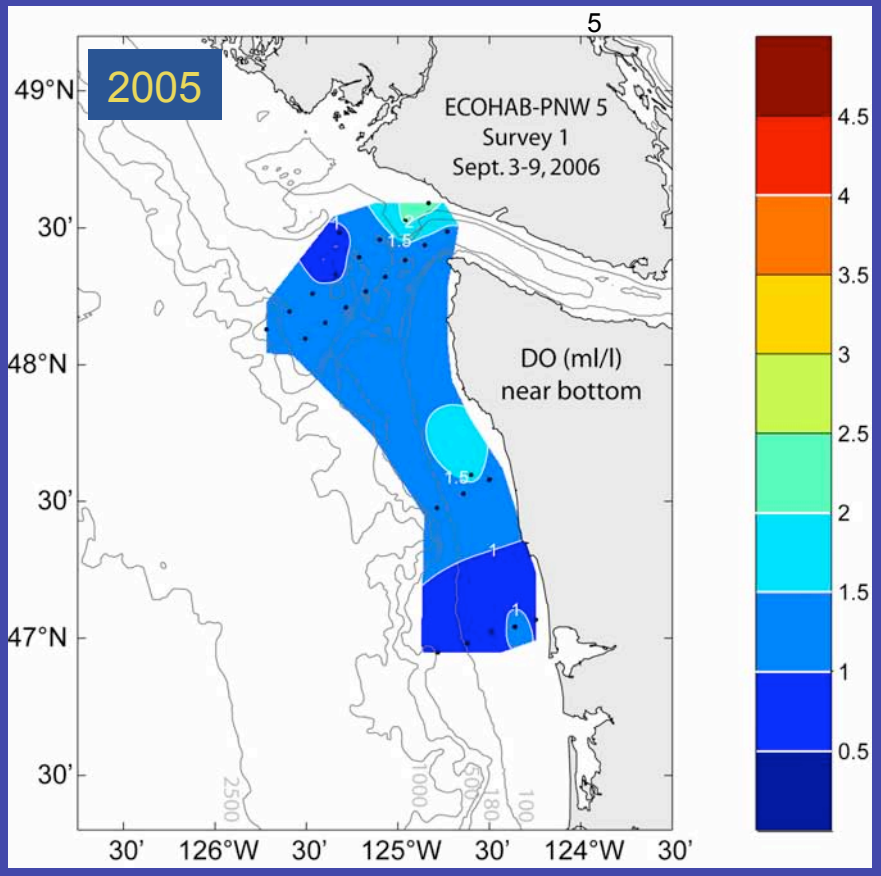
- The Seaglider, developed at UW, is an autonomous vehicle that glides and profiles along programmed routes.
- It will measure many of the same variables as the buoy, temperature, salinity, oxygen, chlorophyll, particles, but gives wider coverage and context.
- In addition, it has been outfitted with an acoustic receiver; this technology is being tested to track the migration of salmon from Puget Sound.
- All of this is cutting edge research, and sorely needed in order to better understand our marine environment and food web.

Location for the Murdock-funded WA coastal sensor array and glider



Hypoxia: Inter-annual variation

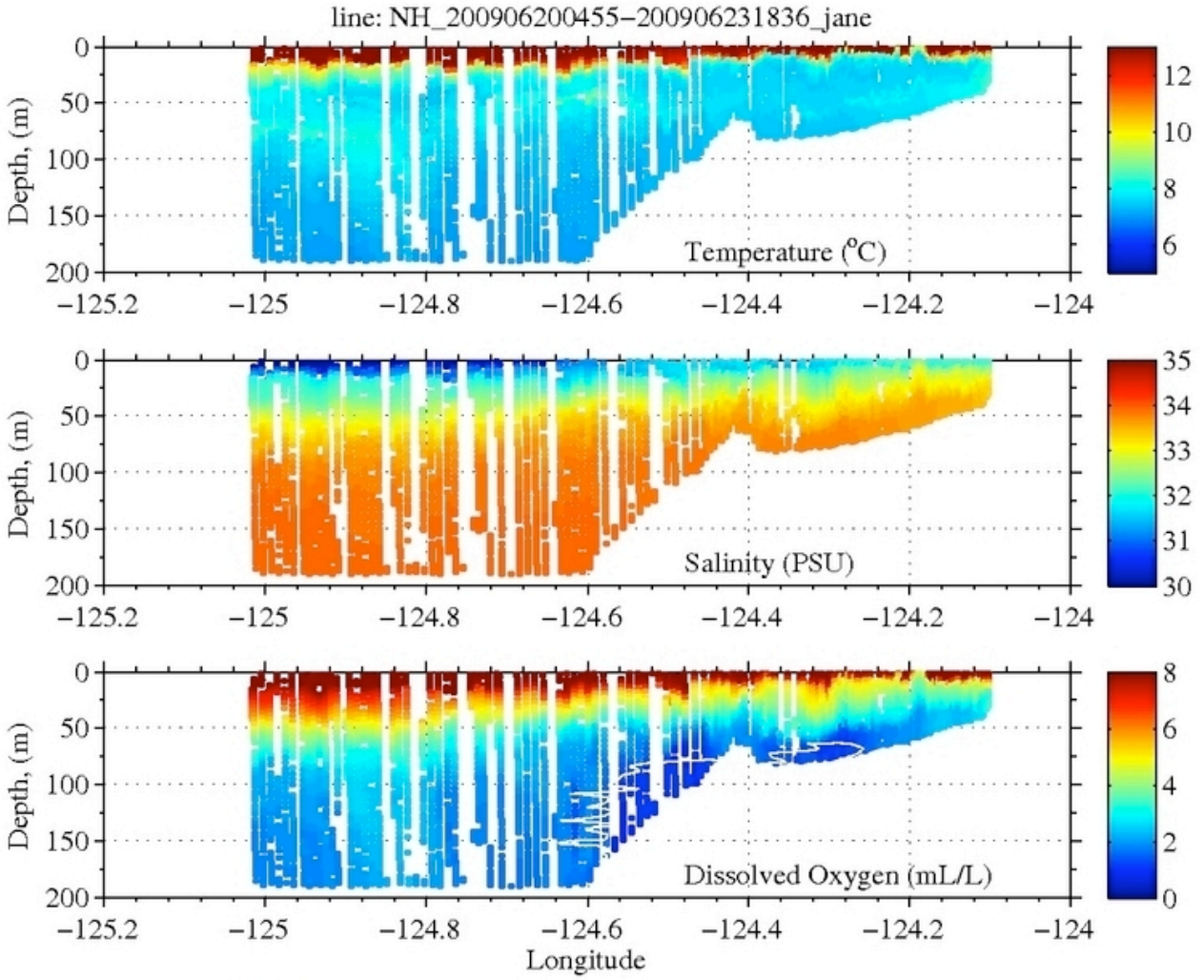




Analysis: Hickey Group, UW

Connolly et al., In Prep.

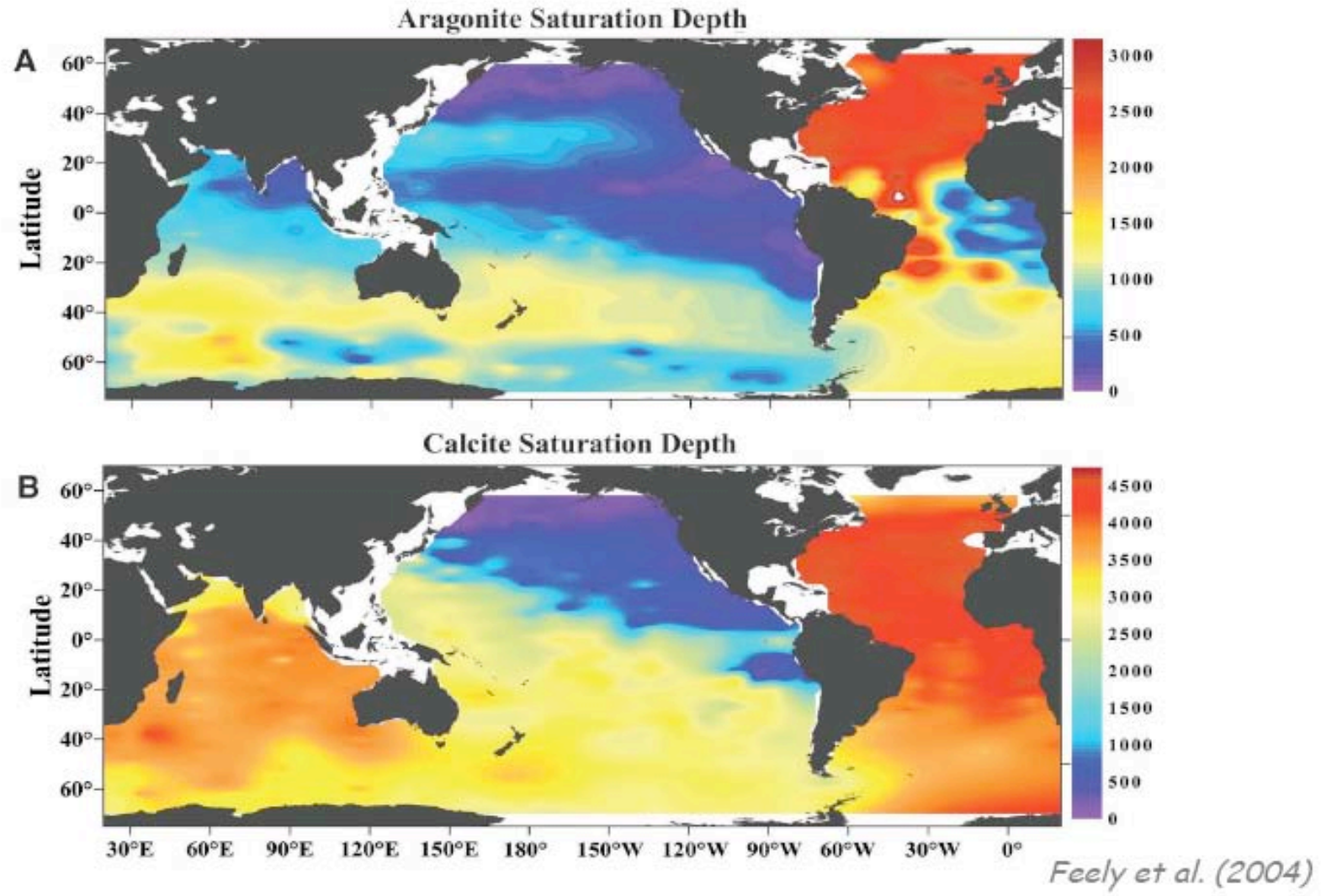
Hypoxia: Glider track off OR



Oregon State University OSU College of Oceanic and Atmospheric Sciences

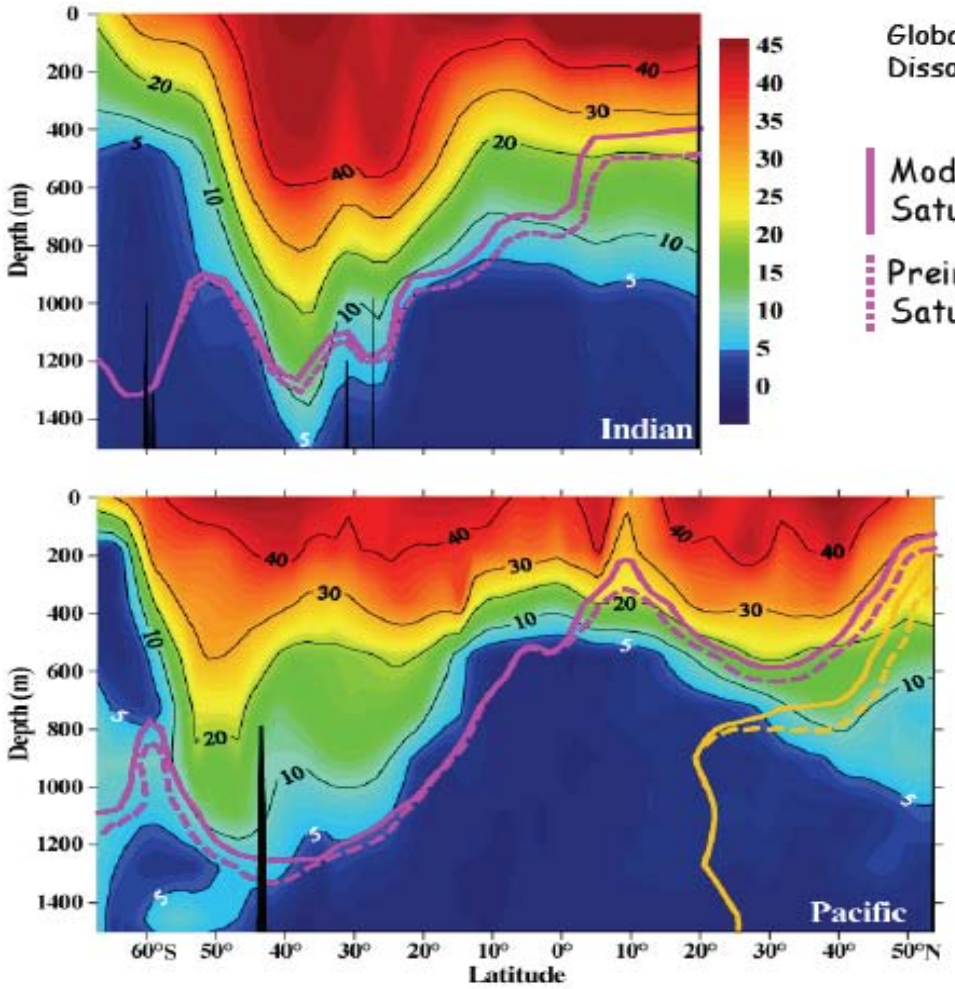
PIs: J. Barth / K. Shearman

Ocean acidification & the Pacific



Feely et al. (2004)

Saturation horizons shoaling



Global Water-column Dissolution = 0.5 Pg C yr^{-1}

Modern Aragonite Saturation Horizon

Modern Calcite Saturation Horizon

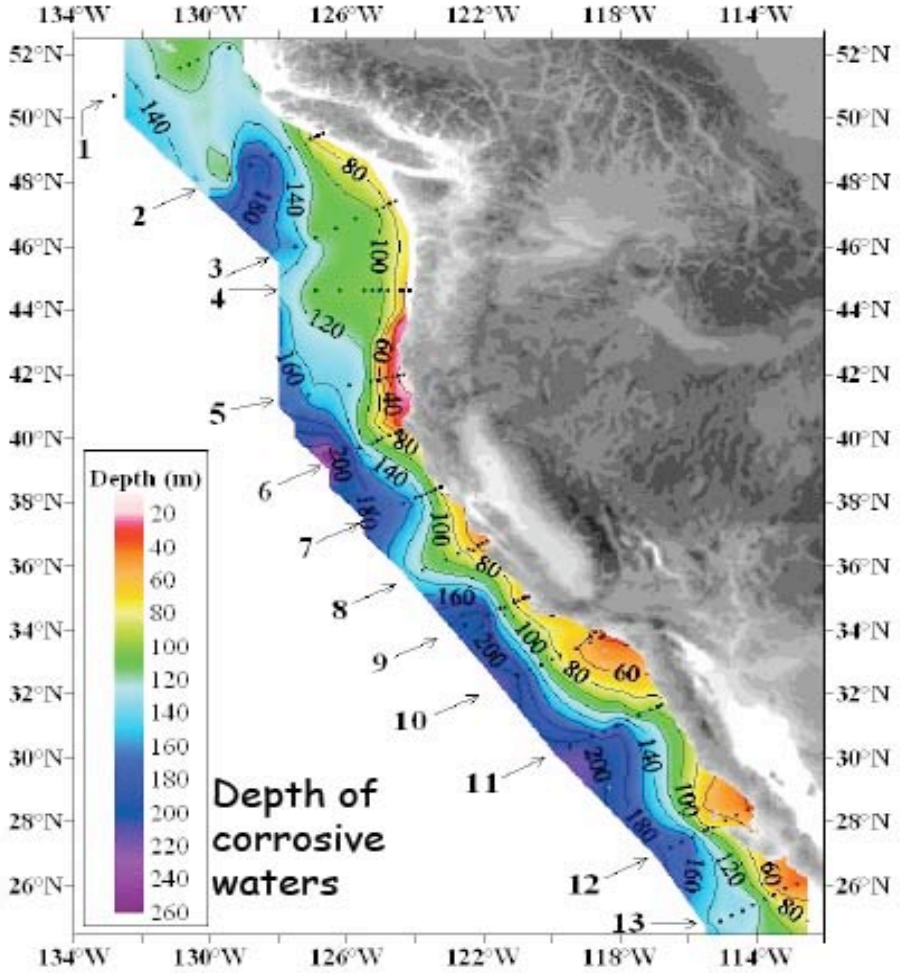
Preindustrial Aragonite Saturation Horizon

Preindustrial Calcite Saturation Horizon

The aragonite and calcite saturation horizons have shoaled towards the surface of the oceans due to the penetration of anthropogenic CO_2 into the oceans.

Feely et al. (2004)

Coastal upwelling brings it up



Ocean Acidification of the North American Continental Shelf

NACP Coastal Survey Cruise:
11 May - 14 June 2007

Distribution of the depths of the corrosive water (aragonite saturation < 1.0; pH < 7.75) on the continental shelf of western North America from Queen Charlotte Sound, Canada to San Gregorio Baja California Sur, Mexico.

On transect lines 5 and 6 the corrosive water reaches all the way to the surface in the inshore waters near the coast.

Feely et al. (2007)

The Seattle Times

Published June 14, 2009

Oysters in deep trouble: Is Pacific Ocean's chemistry killing sea life?

Oyster larvae have been dying by the billions. Scientists suspect it's a sign that carbon dioxide is dramatically affecting the ocean — and if they're right, it could push Washington into the center of the debate about the future of the seas.

By Craig Welch
Seattle Times environment reporter

WILLAPA BAY, Pacific County —

The collapse began rather unspectacularly.

In 2005, when most of the millions of Pacific oysters in this tree-lined estuary failed to reproduce, Washington's shellfish growers largely shrugged it off.

In a region that provides one-sixth of the nation's oysters — the epicenter of the West Coast's $111 million oyster industry — everyone knows nature can be fickle.

But then the failure was repeated in 2006, 2007 and 2008. It spread to an Oregon hatchery that supplies baby oysters to shellfish nurseries from Puget Sound to Los Angeles. Eighty percent of that hatchery's oyster larvae died, too.

PREV 1 of 6 NEXT

enlarge STEVE RINGMAN / THE SEATTLE TIMES

Oysters' failure to reproduce will lead workers like Northern Oyster Co.'s Gildardo Mendoza to collect far more of their product from a state "oyster preserve" in Willapa Bay. Pacific oysters haven't successfully reproduced in the wild since 2004.

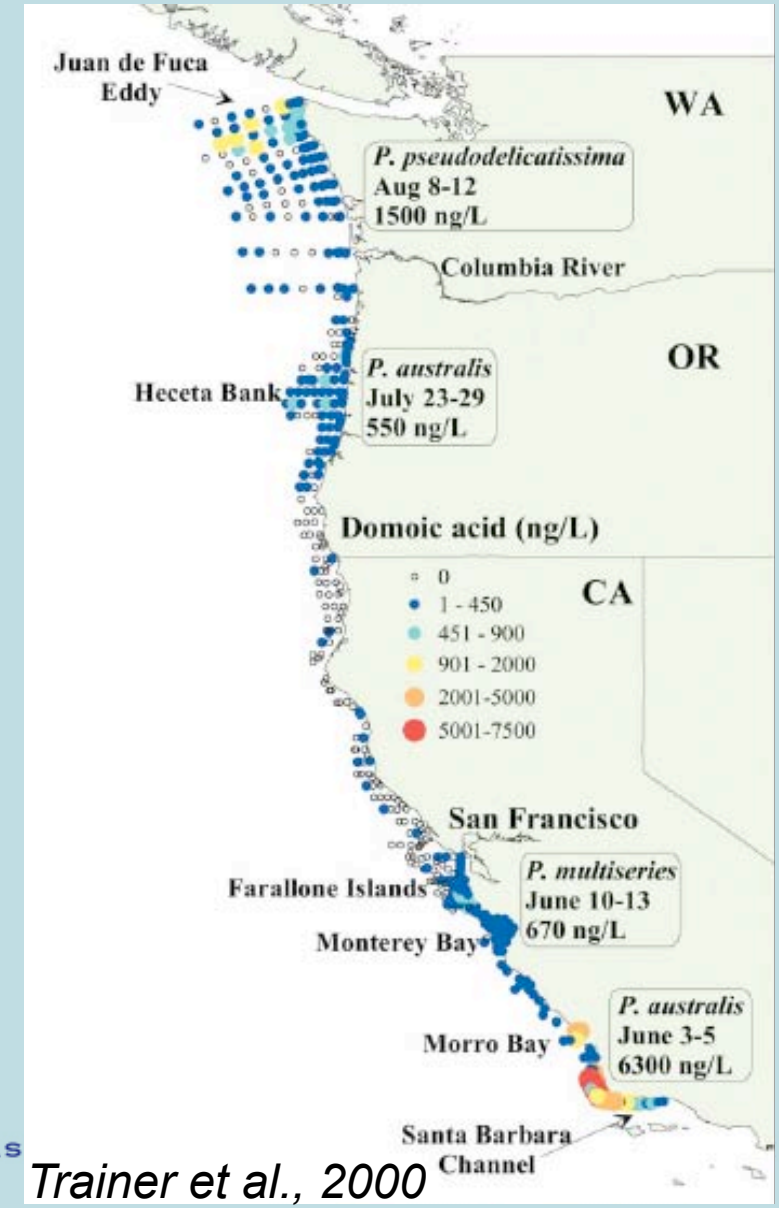
Harmful Algal Blooms

Research focusing on "hot spots" where cells "incubate," then reach coast when winds shift

Study on growth and toxicity dynamics, dispersal, and forecast potential

Juan de Fuca Eddy

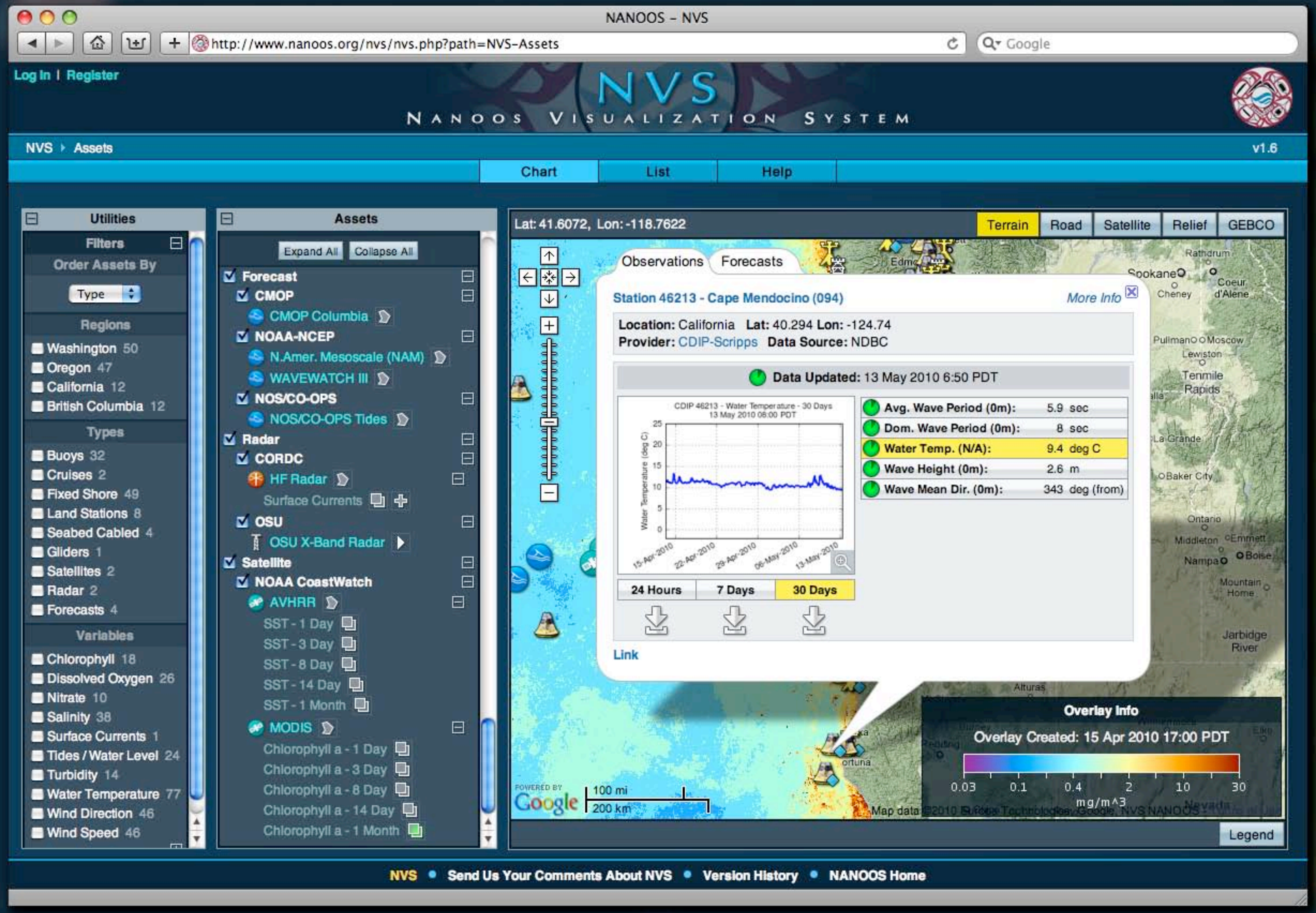
Heceta Bank



Trainer et al., 2000

NVS 1.6

nvs.nanoos.org

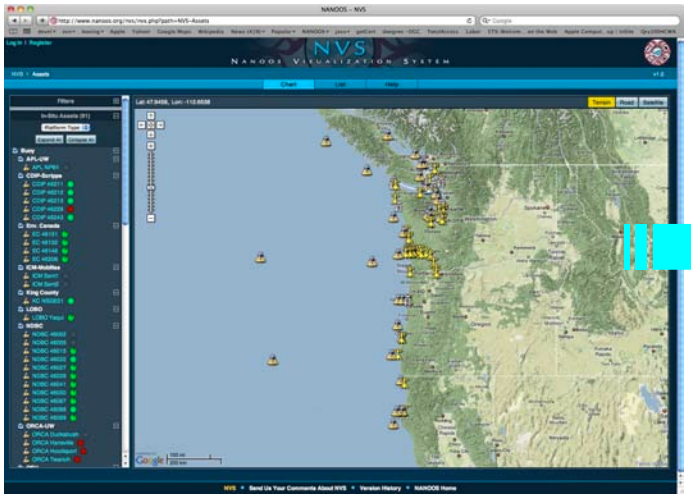


Jon Allen, David Jones, Troy Tanner, Craig Risien

NVS iPhone Application

•Provides unprecedented convenience to a diverse set of users allowing mobile access and viewing of real-time regional ocean-observing information.

NANOOS Visualization System (NVS) for the Web



NANOOS Mobile iPhone App

Assets on Google Map

Sensor Data Values

Trends and Forecasts

Future Features

user-centered asset viewing by geospatial location (GPS),
user-defined event alerting by area or individual asset, and
sophisticated search for sensor asset & data discovery.

May 24, 2010

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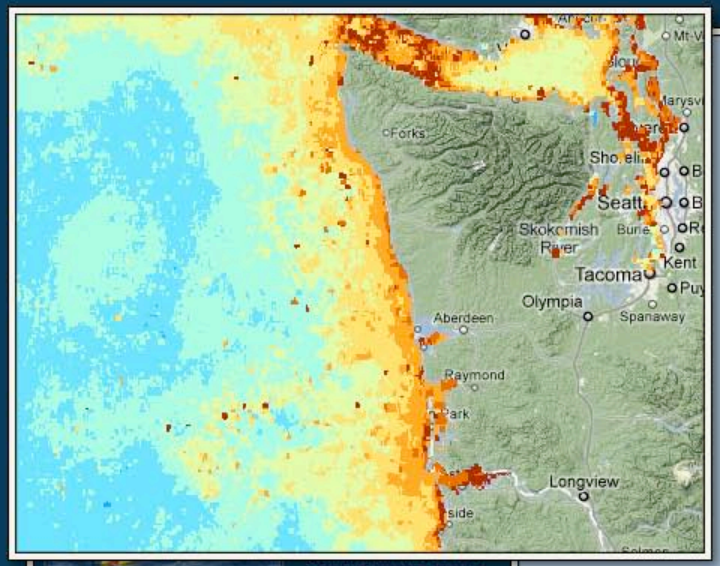
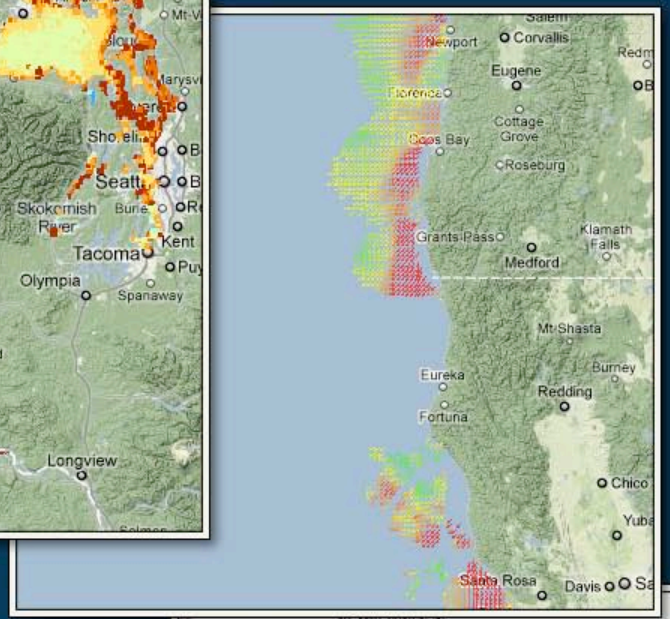
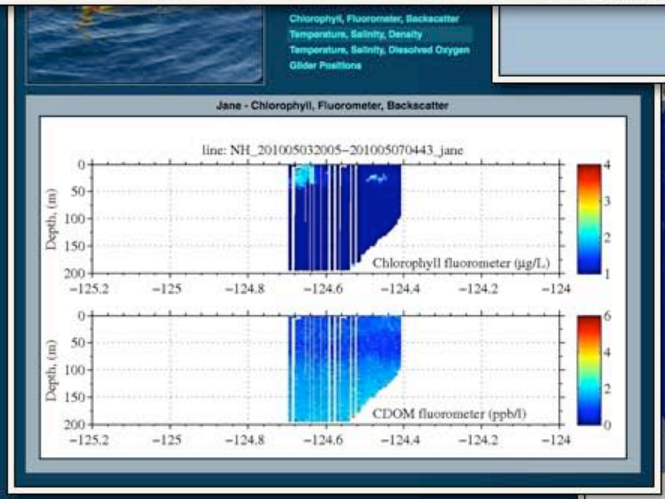
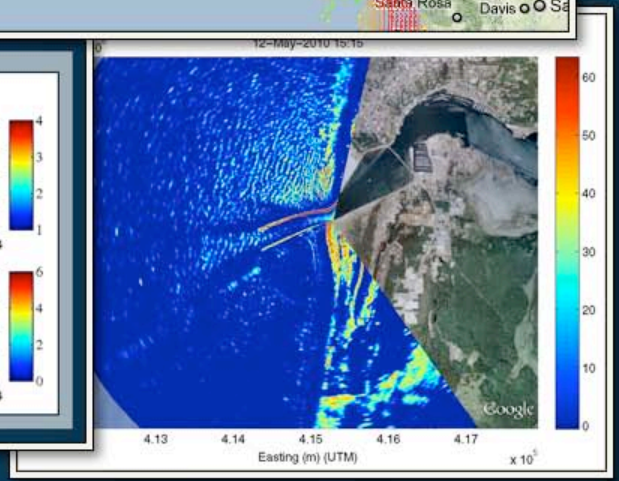
NVS Version 1.6 - Products









- In-Situ Observations
- AVHRR & MODIS
- PRISM Cruise Data
- HF Radar
- OSU Gliders
- NH-10
- X-Band Radar
- *and More*

Jon Allen, David Jones, Troy Tanner, Craig Risien

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Live:

Ocean Acidification is on the Rise

NOAA is studying the growing problem of increased carbon dioxide (CO_2) in the ocean by collecting real-time data through a variety of efforts to determine what's happening to seawater chemistry due to ocean acidification and its impact on organisms that live in the ocean as well as the possible

- Maritime Operations
- Ecosystem Impacts
- Regional Fisheries

Hypoxia in Pacific Northwest Mari

Since 2000, fish and crab kills in the Puget become more common and frequent occurrences.

-Ocean Acidification
-Hypoxia
- HABs

system of

Oregon, a

HY

on 1.6

significant changes are the additions of image overlays, allowing information to be displayed on top of the map. Other improvements include filter

Content development stage:

- Harmful Algal Blooms (HABs)
- Coastal Change and Flood Hazards
- Tsunamis
- Beach Safety
- Marine Spatial Planning

Planning stages:

- Climate Change as a Coastal Hazard
- El Nino/La Nina
- Maritime Operations
- Fisheries


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WASHINGTON - OREGON - NORTHERN CALIFORNIA

Thank you!

Partnerships: the intersection of science, technology & applications